

## CLAIMS

1. An article with an organic-inorganic composite film, the article comprising a substrate and an organic-inorganic composite film that is  
5 formed on a surface of the substrate and contains an organic material and an inorganic oxide,  
wherein the organic-inorganic composite film contains silica as the inorganic oxide,  
the organic-inorganic composite film contains the silica as its main  
10 component, and  
the organic-inorganic composite film does not separate from the substrate after the Taber abrasion test prescribed in Japanese Industrial Standards R 3212 that is carried out with respect to a surface of the  
organic-inorganic composite film.  
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2. The article according to claim 1, wherein the organic-inorganic composite film has a thickness of more than 250 nm but not more than 5  $\mu\text{m}$ .
3. The article according to claim 2, wherein the organic-inorganic  
20 composite film has a thickness of more than 300 nm but not more than 5  $\mu\text{m}$ .
4. The article according to claim 3, wherein the organic-inorganic composite film has a thickness of 1  $\mu\text{m}$  to 5  $\mu\text{m}$ .
- 25 5. The article according to claim 1, wherein a portion that has been subjected to the Taber abrasion test has a haze ratio of 4% or lower after the Taber abrasion test.
6. The article according to claim 1, wherein the content of the organic  
30 material in the organic-inorganic composite film is 0.1 to 60% with respect to the total mass of the organic-inorganic composite film.
7. The article according to claim 1, wherein the organic-inorganic composite film contains phosphorus.  
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8. The article according to claim 1, wherein the organic-inorganic composite film contains a hydrophilic organic polymer as the organic

material.

9. The article according to claim 8, wherein the hydrophilic organic polymer includes a polyoxyalkylene group.

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10. The article according to claim 1, wherein the organic-inorganic composite film contains fine particles.

11. The article according to claim 10, wherein the content of the fine particles is at least 1 mass%, and a portion that has been subjected to the Taber abrasion test has a haze ratio of 4% or lower after the Taber abrasion test.

12. A process for producing an article with an organic-inorganic composite film, the article including a substrate and an organic-inorganic composite film that is formed on a surface of the substrate and contains an organic material and an inorganic oxide, the organic-inorganic composite film containing silica as the inorganic oxide, and the organic-inorganic composite film containing the silica as its main component,

20 the process comprising:

applying a film-forming solution for forming the organic-inorganic composite film to the surface of the substrate; and

removing at least a part of a fluid component contained in the film-forming solution from the film-forming solution that has been applied to the substrate,

wherein the film-forming solution contains silicon alkoxide, strong acid, water, and alcohol,

the film-forming solution further contains a hydrophilic organic polymer to be at least a part of the organic material, as at least a part of the strong acid or as a component other than the strong acid,

the silicon alkoxide has a concentration exceeding 3 mass% in terms of a SiO<sub>2</sub> concentration when silicon atoms contained in the silicon alkoxide are expressed as SiO<sub>2</sub>,

a) in the case where the film-forming solution contains a phosphorus source, the strong acid has a concentration in a range of 0.0001 to 0.2 mol/kg in terms of the molality of protons that is obtained assuming that the protons have dissociated completely from the strong acid,

b) in the case where the film-forming solution contains no phosphorus source, the strong acid has a concentration in a range of 0.001 to 0.2 mol/kg in terms of the molality of protons that is obtained assuming that the protons have dissociated completely from the strong acid, and the silicon alkoxide has  
5 a concentration of lower than 13 mass% in terms of the SiO<sub>2</sub> concentration, the number of moles of the water is at least four times the total number of moles of the silicon atoms contained in the silicon alkoxide, and at least a part of the fluid component contained in the film-forming solution that has been applied to the substrate is removed, with the substrate  
10 being maintained at a temperature of 400°C or lower.

13. The process for producing an article according to claim 12, wherein the concentration of the hydrophilic organic polymer is:  
c) 30 mass% or lower with respect to the SiO<sub>2</sub>, in the case where the  
15 silicon alkoxide has a concentration of 9 mass% or lower in terms of the SiO<sub>2</sub> concentration, and  
d) (5A – 15) mass% or lower where A denotes the SiO<sub>2</sub> concentration, in the case where the silicon alkoxide has a concentration exceeding 9 mass% in terms of the SiO<sub>2</sub> concentration.

20 14. The process for producing an article according to claim 12, wherein the silicon alkoxide contains at least one selected from tetraalkoxysilane and a material made by polymerization of tetraalkoxysilane.

25 15. The process for producing an article according to claim 12, wherein the silicon alkoxide has a concentration of 30 mass% or lower in terms of the SiO<sub>2</sub> concentration.

30 16. The process for producing an article according to claim 12, wherein at least a part of the phosphorus source is phosphoric acid that is contained as at least a part of the strong acid.

35 17. The process for producing an article according to claim 12, wherein at least a part of the phosphorus source is a phosphoester group that is contained in the hydrophilic organic polymer.

18. The process for producing an article according to claim 12, wherein

the hydrophilic organic polymer contains a polyoxyalkylene group.

19. The process for producing an article according to claim 12, wherein  
the number of moles of the water is 5 to 20 times the total number of moles of  
5 the silicon atoms that are contained in the silicon alkoxide.

20. The process for producing an article according to claim 12, wherein  
the film-forming solution further contains fine particles.

10 21. The process for producing an article according to claim 12, wherein  
the organic-inorganic composite film with a thickness of more than 250 nm  
but not more than 5  $\mu\text{m}$  is formed by carrying out each of the following steps  
once: a step of applying the film-forming solution; and a step of removing at  
least a part of the fluid component contained in the film-forming solution that  
15 has been applied.